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The Incidence of Precocious Puberty in Developing Beef Heifers

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Summary

The objectives were to determine the incidence of precocious puberty in developing beef heifers and if exposure to sterile bulls affects the incidence of precocious puberty. The experiment was conducted during 1990 and 1991 in which 120 MARC III heifers were used. Heifer calves and their dams were randomly assigned to be pastured in the presence (n=30 head/year) or absence (n=30 head/year) of a sterile bull starting at 140 ± 1.4 days of age through the duration of the study (402 ± 1.4 days of age). Heifers were considered to have exhibited a precocious puberty if the onset of luteal function was prior to 300 days of age. Average age of puberty in the beef physiology herd is 430 ± 8.7 days of age. There was no effect of exposure to a mature sterile male on the incidence of precocious puberty, therefore, the data were pooled within year. The incidence of precocious puberty was greater in 1990 (25.0 ± 5.5%; 15 of 60) compared to 1991 (8.3 ± 3.5%; 5 of 60). There was no effect of year on the time of initiation of precocious puberty (194 ± 12.4 days of age), duration of time over which estrous cycles occurred (65 ± 10.5 days) or the resumption of anestrus (260 ± 15.3 days of age). Precocious puberty does occur in developing beef heifers with as much as 25% of heifers showing some signs of luteal function before 300 days of age. However, exposure to a sterile bull had no effect on the incidence of precocious puberty.

Introduction

In the current cow-calf production system in the United States when restricted breeding seasons are used a heifer must calve by two years of age to obtain maximum lifetime productivity. Heifers that reach puberty at a younger age and have ≥ 3 estrous cycles have a greater chance of conceiving early in their first breeding season than contemporaries. Due to the longer postpartum period of anestrus of first-calf cows calving at two years age, heifers that conceive early in the breeding season have a greater opportunity to initiate estrous cycles before the next breeding season and become pregnant. In contrast, heifers that do not reach puberty until after the breeding season starts, conceive later in the breeding season and subsequently calve later the following year. Calving late in the calving season increases the chances of heifers not becoming pregnant during the following breeding season and being lost from the herd. Therefore, age at puberty is an important reproductive trait in developing replacement heifers.

Improved management practices and selection of reproductive traits have enhanced the physiological processes associated with attainment of puberty to maximize the number of heifers that reach puberty before the breeding season. Development of replacement heifers in the presence of a mature sterile bull is a management practice that decreases the age at which puberty is attained compared to heifers developed in the absence of a bull. However, increased selection pressure applied to age of puberty in heifers and the subsequent decrease in age at puberty has some disadvantages. Heifers reaching puberty and initiating estrous cycles at a young age while still suckling their dams are often exposed to fertile bulls during the dams breeding season or to intact male calves before weaning. Exposure to fertile bulls during this time period could result in heifers that become pregnant at a very young age and calve as yearlings. These heifers usually conceive late in the breeding season and calve late or after the normal calving season as yearlings. These heifers are of small body size which increases the chances of dystocia that sometimes results in loss of the calf and/or heifer, increased labor and time required for postpartum recovery. The combination of small body size and increased dystocia result in the majority of these animals failing to conceive during the following breeding season. Money invested in developing the heifer would be lost. In addition, precocious puberty in heifers that are destined to be sold as market animals results in heifers becoming pregnant prior to entering the feedlot. Pregnant feedlot heifers have decreased feed efficiency and growth rate compared to non-pregnant heifers which is a factor for lower prices paid by feedlots for heifers compared to steers. The research objectives were to determine the percentage of heifers developed at the University of Nebraska research station that exhibit precocious puberty and if exposure to bulls would affect the incidence of precocious puberty.

Procedure

The experiment was conducted at the Cow/Calf Unit of the University of Nebraska Agriculture Research and Development Center located at Mead Nebraska during 1990 and 1991. A total of 120 MARC III (25% Angus, 25% Hereford, 25% Red Poll and 25% Pinzgauer) heifers were used over two years (60 heifers/year). Heifer calves and their dams were randomly assigned when heifers

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were 140 ± 1.4 days of age to be pastured with or without sterile bulls throughout the duration of the study. After weaning (October 12 each year), heifers were maintained within their group on pasture and supplemented as needed with a corn-based diet and prairie hay to gain 1.25 pounds daily. Blood samples were collected weekly through 402 ± 1.4 days of age to determine the concentrations of progesterone indicative of the onset of luteal function and puberty. Heifers were determined to have luteal function when concentrations of progesterone increased above 1 ng/ml for two consecutive samples (7 days apart) or above 2 ng/ml in one sample with continued cyclic profiles of progesterone concentration indicative of normal estrous cycles. After initiation of luteal function, heifers were determined to have returned to anestrus if the concentrations of progesterone in three consecutive samples (14 days apart) were below 1 ng/ml. Previous research showed heifers within this herd reach puberty at an average of 430 ± 8.7 days of age. Heifers were considered to have precocious puberty when luteal function was initiated before 300 days of age.

Results and Discussion

There was no affect of exposure of heifers to sterile bulls on the frequency or the age of precocious puberty, therefore, data were pooled within year. Frequency of precocious puberty is presented in Table 1. The frequency of precocious puberty was greater ($P < 0.02$) in 1990 (25.0 ± 3.5%; 15 of 60) compared to 1991 (8.3 ± 3.5%; 5 of 60). Figure 1 depicts the progesterone profiles of four representative heifers. Figure 1A depicts progesterone concentrations in a representative heifer which attained puberty at a typical time for this herd. Figure 1B through 1D depicts progesterone concentrations of

Table 1. Characteristics of precocious puberty in developing beef heifers.

	No. of Heifers	Heifers with Precocious Puberty (n)	(Percent[a])	Age at Puberty (Day)	Age at Anestrus (Day)	Duration of cycles (Day)
1990						
Bull Exposed	30	7	23.3	190±1.6	256±2.2	66±2.0
Non-exposed	30	8	26.7	220±2.4	292±2.7	73±1.8
1991						
Bull Exposed	30	3	10.0	164±2.5	210±2.5	46±2.4
Non-exposed	30	2	6.7	150±1.0	220±2.9	70±2.8

[a]The percentage of heifers exhibiting precocious puberty was affected by year ($P<0.02$).

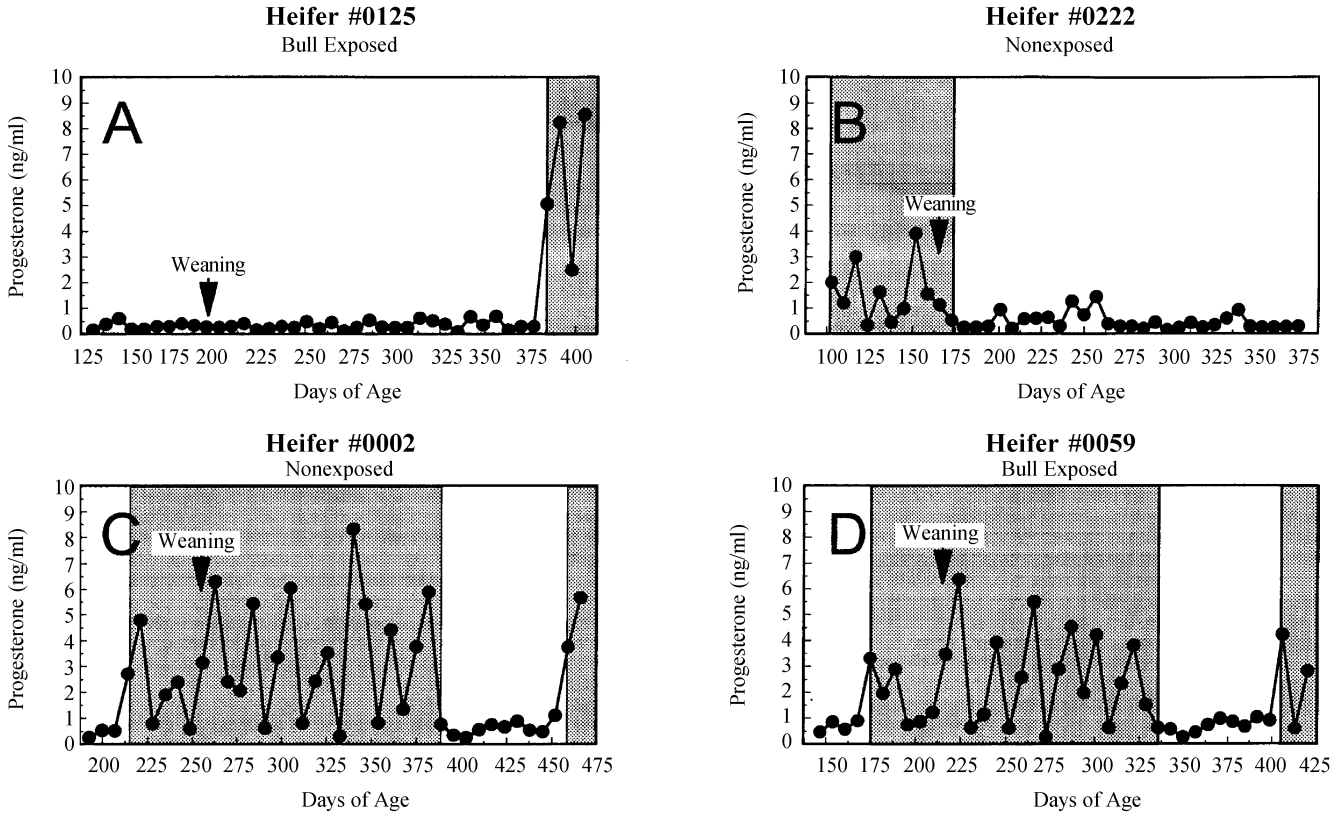

Figure 1. Representative progesterone profiles of developing beef heifers with either a normal (A) onset of luteal function or a precocious (B, C and D) onset of luteal function. Shaded areas identify periods of time when heifers were determined to have luteal function indicative of typical estrous cycles.

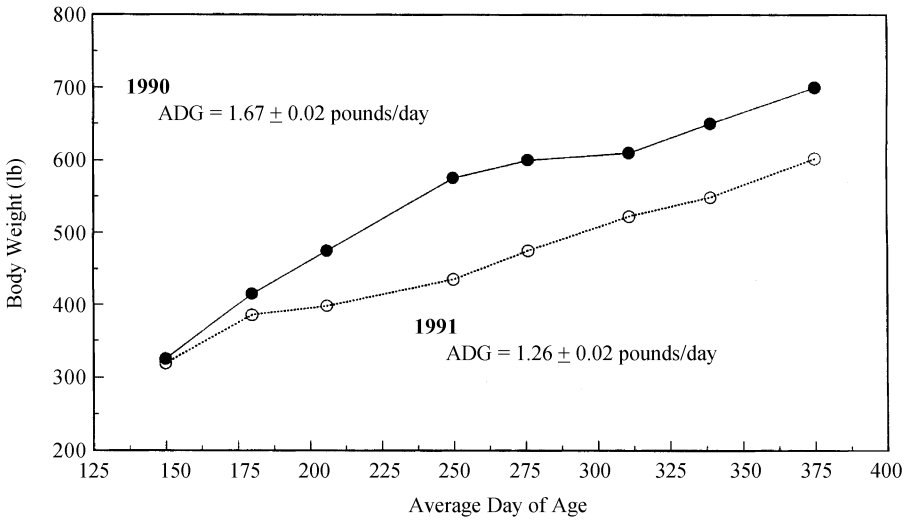

Figure 2. Average weight of developing beef heifers maintained on pasture and supplemented with a corn based diet and prairie hay.

heifers in which precocious puberty was detected. Heifer number 0222 (Figure 1B) had increased concentrations of progesterone at the initiation of the study at 100 days of age and would have had estrous cycles during the dams breeding season. However, this individual was in the non-exposed group and was not exposed to a fertile bull. In each heifer that exhibited a precocious puberty, there is a periodic increase in concentrations of progesterone indicative of cyclic luteal function. All heifers that did exhibit precocious puberty became anestrus for a period of time before the end of the study.

There was no affect of year on the time of initiation of precocious puberty (194 ± 12.4 days of age), duration of luteal function (65 ± 10.5 days) or the time of resumption of anestrus (260 ± 15.3 days of age). Figure 2 depicts the growth rate of the heifers during 1990 and 1991. During 1990, the availability of forage was much greater which likely resulted in heifers gaining a greater amount of weight during the 2 months after weaning compared to heifers in 1991. The increased growth rate resulted in an overall average daily gain of 1.67 ± 0.02 pounds/day compared to 1.26 ± 0.02 pounds/day. The greater growth rate after weaning resulted in heifers reaching approximately the same body weight at 275 days of age in 1990 compared to 375 days of age in 1991. The greater growth rate and overall body weight in 1990 could explain the increased incidence of precocious puberty in 1990 compared to 1991. At the completion of the study (402 ± 1.4 days of age), the percentage of heifers that had not initiated luteal function was 55% (33 of 60) in 1990 and 82% (49 of 60) in 1991.

The current study indicates precocious puberty does exist in developing beef heifers. The incidence of precocious puberty is not affected by the presence of a bull. In addition, the incidence of precocious puberty may be related to growth rate of the heifer around the time of weaning.

These studies indicate that the incidence of precocious puberty may be more related to internal cues and less responsive to environmental cues that are normally associated with the attainment of puberty. Precocious puberty does occur in developing heifers with as many as 25% of heifers exhibiting transient luteal function before 300 days of age. Therefore, producers should consider the possibility of precocious puberty in heifers when making management decisions such as prolonged breeding seasons or delayed castration of herd mates.

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